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FIREPLACE FUNGI IN AN ARCTIC AREA: MIDDLE WEST GREENLAND

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ABSTRACT

The fungus flora on burnt ground has been investigated in a number of localities in middle West Greenland. It is established that although fire is an ecological factor of only minor importance in middle West Greenland as well as in the Arctic as a whole, fireplace fungi are of widespread and common occurrence in the investigation area. A total of 16 obligate fireplace fungi were found, of which 13 species have not hitherto been recorded from Greenland.

INTRODUCTION

In a previous series of investigations, the ecology of the fireplace fungi has been studied in Denmark, an area of temperate climate. A three year stay at the Arctic Station in Godhavn, West Greenland, provided an opportunity to extend the studies into the Arctic. The sporadic occurrence of burns in natural habitats, the long travelling distances, and the shortness of the fungus season made it impossible to visit most of the localities more than once. Therefore, the present paper is mainly a contribution to the knowledge of the distributional area of some of the fireplace fungi, although some ecological conclusions may also be drawn.

THE INVESTIGATION AREA

The investigation area extends from Godhavn (69° 14′ N, 53° 31′ W) in the north, to Holsteinsborg (66° 55′ N, 53° 40′ W) in the

FINDS OF FIREPLACE FUNGI ON PICNIC HEARTHS NEAR GODHAVN

During the summer, families from Godhavn often arrange picnics to the surroundings of the town. A fire is made up, using *Empetrum hermaphroditum* as fuel. The picnic hearth is generally placed adjacent to a rock and bordered by stones, the area rarely exceeding 0.1 square meter. After the fire, a heap of ash is left surrounded by a narrow margin of scorched humus; the humus layer below the ash may also be more or less charred.

Even though the stones bordering the picnic hearth provide some shelter against desiccation, the majority of the fireplace fungi does not appear until September, when the weather becomes sufficiently moist (cfr. Table 2) while the peak of the general fungus season occurs in the first half of August.

Most often the age of a picnic hearth could not be established. In a few cases, however, it was possible to ascertain that a particular picnic hearth definitely originated in the same summer, for example in the case of finds of *Anthracobia maurilabra, Geopyxis carbonaria, Peziza praetervisa,* and *Tricharina gilva.* At the time of the appearance of the fruit bodies, these picnic hearths must have been six to twelve weeks old. In one case, *Peziza echinospora* was observed on the same picnic hearth in two subsequent seasons. Each picnic hearth

TABLE 2.

Dates for finds of fireplace fungi on picnic hearths near Godhavn. The fact that the winter of 1971 set in very early explains the single find from that year.

Species	1970	1971	1972
Anthracobia maurilabra			18.9.
Ascobolus carbonarius	19.9.		
Geopyxis carbonaria	25.9.		
Humaria hemisphaerioides			22.8.
Peziza anthracina	19.9.		
P. echinospora	19.9.	30.8.	
P. praetervisa	4.9., 29.9., 30.9.		22.8.
Tricharina gilva	4.9., 10.9.		2.8., 22.8., 31.8., 18.9., 18.9.

usually supported only a single species, if any at all, most probably due to its small area. However, on one occasion *Anthracobia maurilabra, Peziza praetervisa,* and *Tricharina gilva* occurred together.

Table 2 shows the finds of fireplace fungi on picnic hearths near Godhavn. *Tricharina gilva* appears as the most common species. The occurrence of *Geopyxis carbonaria* on a picnic hearth in a dwarf shrub heath with *Salix glauca, S. herbacea,* and *Empetrum hermaphroditum* is interesting as this species has hitherto only been recorded for localities with coniferous trees.

OCCURRENCES AFTER EXPERIMENTAL BURNING

An attempt was made to investigate the influence of the vegetation type and the time since burning on the fungus flora of burnt ground. 25 and 20 experimental plots were burned in the Blæsedalen valley, near Godhavn, in the middle of June 1971 and 1972 respectively. Each plot measured 1 square meter; it was drenched with 0.5-1 liter gas oil and ignited. The burning lasted from 5 to 15 minutes, depending on the vegetation type. The ground was left scorched and with some charred wood in those cases where *Betula nana* and *Salix glauca* were present. The plots were allocated as follows (1971 + 1972): *Salix glauca*-scrub on moist ground (5 + 5), *Betula nana*-heath (5 + 5), *Empetrum hermaphroditum*-heath (5 + 5), *Vaccinium uliginosum*-heath rich in lichens (5 + 5), and *Salix herbacea* snow-bed (5 + 0).

This experiment largely failed because the experimental plots had been placed in relatively large areas of homogeneous vegetation, which were devoid of any relief that could serve as shelter against desiccation. Even in the relatively moist summer of 1972, the soil surface dried out in the course of one or two days after rainfall. Only a single plot in the *Salix glauca*-scrub, burned in 1972, yielded fruit bodies: *Mycena aetites* 18.8.1972, 8 weeks after burning, and *Mycena uracea* 14.9.1972, 12 weeks after burning.

FLORISTIC INVESTIGATION OF LARGER AREAS OF BURNT NATURAL VEGETATION

1. kuanit, ca. 4 km east of Godhavn. A small area, only 25 square meter. Burned about August 1971, visited 15. September 1972, 13

Fig. 2. The burnt area at Holsteinsborg, lying centrally in the middle-ground and characterized by the light coloured boulders.

months after burning. The vegetation of dwarf shrub heath and low growing *Salix glauca* had been killed and the humus layer scorched and locally totally combusted. The only fungi found were an *Octospora* sp. and *Pholiota carbonaria.*

2. Burnt area 4 km northeast of Holsteinsborg. An approximately rectangular area on a south facing slope, ca. 7 ha (Fig. 2). Burned 8.-10. July 1971, visited 27. August 1972, 14 months after burning. Previous to the fire, the area had been covered with *Salix glauca*-scrub, 0.5 m high, with a field layer of herbs; particularly on the upper part of the slope *Salix glauca* was mixed with *Betula nana* and a few *Juniperus communis* ssp. *nana.* The lower eastern part of the area had been covered with a dry *Empetrum hermaphroditum*-heath, rich in lichens.

The fire must have been intense. The above-ground parts of the willows were dead, but at the time of the visit, new shoots were developing from the below-ground parts. The litter layer had been combusted and the humus layer was scorched. Here and there even the humus layer had burned, resulting in the formation of hollows with an ash layer, of a few cm thickness. This was especially the case where the humus layer had covered stones and rocks (Fig. 3).

In order to provide some insight into the edaphic conditions, pH was measured in a number of fresh samples. The samples were

Fig. 3. The western edge of the burnt area at Holsteinsborg. To the left the undamaged *Salix glauca*-scrub and to the right a part of the burnt area. Numerous bare boulders are seen at the surface after the vegetation and the humus layer have been destroyed by the fire.

suspended in distilled water (soil: water ca. 1:5 by volume) and left overnight, before pH of the suspension was measured by means of a combined glass-calomel electrode. Five samples of scorched humus gave the values of 6.1, 6.6, 6.6, 7.0, and 7.0, whereas five samples of ash from the hollows gave values of 7.9, 8.0, 8.1, 8.3, and 8.4. At three places, a soil profile was sampled just inside and outside the burnt area in order to compare the present conditions with those existing prior to burning. The pH of these samples is given in Table 3.

The following species were found on the burnt area: *Anthracobia macrocystis, A. maurilabra,* and *A. melaloma* occurred on the north side of larger stones and tussocks; the fruit bodies were often found above dead branches of *Salix glauca* which were buried in the soil.

Mycena aetites, M. citronomarginata, and *M. phyllogena* occurred sparsely where the humus layer was only slightly scorched and kept moist by percolating water. *Peziza anthracina, P. praetervisa,* and *P. trachycarpa* occurred both in the hollows and on the scorched humus. *Peziza echinospora* was found a few times on the scorched humus. *Pholiota carbonaria* appeared as solitary fruit bodies at three places, whilst *Tricharina gilva* occurred in the hollows.

3. Burnt area at angnertussup qaqai (68° 33′ N, 52° 00′ W), ca. 40 km east-southeast of Egedesminde. Burned in the summer of

TABLE 3.

pH of fresh samples from horizons in corresponding profiles just outside and inside the burnt area, Holsteinsborg (27.8.1972, 14 months after burning).

	Unburnt area		Corresponding burnt area	
Vegetation	Horizon	pH	Horizon	pH
Moist dwarf shrub heath	2 cm litter	5.7	2 cm scorched litter	6.4
	Humus layer	6.1	13 cm humus	6.0
			Mineral soil	5.9
Dry *Empetrum*-heath rich in lichens	Litter	4.7	1 cm scorched humus	6.3
	Mixed humus and mineral soil	5.1	11 cm humus	5.6
			Mineral soil	5.5
Salix glauca-scrub	1 cm litter	6.1	3 cm scorched litter and humus	6.2
	5 cm humus	6.1	6 cm humus	5.6
	Mineral soil	5.9	Mineral soil	5.3

1969; visited 8. August 1972, three years after burning. Only a part of the very large burnt area was investigated (Fig. 4), i. e. a south facing slope, where the previous dry herb-slope vegetation with scattered *Salix glauca* was replaced by *Ceratodon purpureus* and scattered herbs, the willows being more or less dead. The foot of this slope together with a more or less moist, level area above the slope were also investigated. The level area had previously been covered with dwarf shrub heath (*Betula nana, Empetrum hermaphroditum, Ledum palustre, Salix glauca, Vaccinium uliginosum, V. vitis-idaea*) rich in mosses and lichens; after burning a dense carpet of *Ceratodon purpureus, Polytrichum septentrionale,* and luxuriant tussocks of various grasses and sedges had developed.

On the south facing slope the following species were very common: *Hebeloma crustuliniforme, H. mesophaeum,* and *Psilocybe montana.*

Fig. 4. The burnt area at agnertussup qaqai, lying in the middelground, to the right, and characterized by the light coloured rocks and boulders.

Common species were: *Bovista echinella, Galerina moelleri* (very large specimens), *Laccaria altaica, L. laccata,* and *Omphalina rustica.*

Species found once or very infrequently: *Arrhenia auriscalpium, Coprinus angulatus* (solitary fruit bodies at three places), *Morchella conica, Mycena aetites* (very dark form), *Omphalina grisella, Phaeomarasmius carpophiloides, Polyporus melanopus, Pyronema omphalodes, Sepultaria arenicola, Sphaerosporella hinnulea,* and *Tephrocybe carbonaria* (in cracks in the moss carpet).

The following species occurred in the moss carpet on the level area above the slope: *Galerina heterocystis, G. moelleri, G. vittaeformis, Mitrula gracilis* (abundant), *Octospora humosa,* and *Omphalina ericetorum.*

Finally, the following species occurred on the fresh soil of a landslide resulting from the destruction of the vegetation on the slope: *Ascobolus carbonarius, Humaria gregaria,* and *Peziza* cfr. *limnaea.*

DISCUSSION

During the present investigation a total of 42 species of macromycetes were found on burnt ground. No less than 16 of these species are considered obligate fireplace fungi:

Anthracobia macrocystis,
A. maurilabra,
A. melaloma,
Ascobolus carbonarius,
Coprinus angulatus,
Geopyxis carbonaria,
Humaria hemisphaerioides,
Peziza anthracina,
P. echinospora,
P. praetervisa,
P. trachycarpa,
Pholiota carbonaria,
Pyronema omphalodes,
Sphaerosporella hinnulea,
Tephrocybe carbonaria,
Tricharina gilva.

All these species occur in temperate areas (cp. e. g. EBERT (1958), MOSER (1949) P. MILAN PETERSEN (1970, 1971), PIRK (1950)), but only a few have previously been recorded from arctic or alpine areas. M. LANGE (1955, 1957) reported *Coprinus angulatus, Pholiota carbonaria,* and *Tephrocybe carbonaria* from West Greenland. All the other species mentioned above have not previously been recorded from Greenland.

The role of fire as an ecological factor in natural arctic vegetation is insignificant. In all the areas investigated, burning was a result of the activity of man. In this respect, the occurrence of at least 16 species of obligate fireplace fungi may at first seem surprising, compared with the 33 species found in Denmark as a result of extensive investigation of much more varied localities (P. MILAN PETERSEN 1970, 1971). It is, however, possible that the vegetative state of these species are common elements in the soil microflora of undisturbed arctic heath and scrub. The investigations in Denmark have shown that all the species mentioned, with the exception of *Sphaerosporella hinnulea,* are able to form fruit bodies within two to four months after burning; this is an ability which makes them well fitted to the short summers of the Arctic.

The relationship between the appearance of the individual species and the time since burning cannot be determined on the basis of the present material alone. However, in all those cases where the age of the picnic hearths and burnt areas has been established, the observations agree with those made in Denmark.

Though only cursorily studied, the edaphic conditions in the burnt areas closely parallel the Danish observations. The pH-values for the scorched humus and the ash in the hollows in the burnt area at Holsteinsborg largely correspond with those found in similar situations after a forest fire in a Danish coniferous plantation. It is clear

that in the Arctic, the changes in pH are similarly confined to the uppermost soil layers (cp. Table 3).

About two thirds of the recorded species are not considered obligate fireplace fungi; many of them occurred exclusively in the oldest burnt area, at angnertussup qaqai. Some of the species which are common on unburnt ground in the investigation area, had become extremely abundant in the burnt area due to the luxuriant development of the moss carpet (e. g. the *Galerina* spp., *Mitrula gracilis,* and *Psilocybe montana*) or due to the kililng of the shrubs, especially *Salix glauca* (e. g. *Hebeloma crustuliniforme, H. mesophaeum,* and the *Laccaria* spp.). The occurrence of some otherwise rare species has no doubt also been promoted by the secondary effects of the fire, for example *Humaria gregaria, Morchella conica,* and *Sepultaria arenicola* by the changed edaphic conditions, and *Polyporus melanopus* by the production of large amounts of suitable substrate in the form of dead roots and branches of *Salix glauca.*

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